

Water Defying Gravity

Demonstrate the effects of temperature on pressure by making water rise against gravity into a flask.

Difficulty / Time Commitment:

7 out of 10

Coolness Factor:

8 out of 10

Materials:

- 1000mL Erlenmeyer flask with a mouth of 1.5” diameter (other similar flasks should work)
- small plate
- candle 2-5” tall and 1” or less in diameter
- matches or lighter
- food coloring
- clay or play-doh

Instructions:

1. Place the candle upright in the center of the small plate. Clay or play-doh may help the candle to stay upright.
2. Pour a layer of water onto the plate, dyeing the water with food coloring so that it is easier to see.
3. Light the upright candle.
4. Carefully place the Erlenmeyer flask upside-down onto the plate, making sure that the candle fits through the neck of the flask. Watch the candle flame go out, and the water rise up into the flask.

What Happened?

Putting the flask over the candle caused the candle to go out, and the internal temperature dropped suddenly, leading to lower pressure in the flask relative to outside the flask. The water acts like air and moves from high pressure outside the flask to the low pressure inside, even though this is against gravity. The concepts in this experiment are quite similar to Egg in a Bottle.

Basic Concepts Learned:

- The water goes from high to low pressure, just like the wind blows from high to low pressure, thus the pressure force acts from high to low.
- The ideal gas law states that $pV=nRT$. Pressure (p) can be changed by either changing the temperature (T) or by changing the number of air molecules (n). (R is a constant.) Under constant volume, more air molecules and higher temperatures lead to higher pressure. In this experiment, we used temperature changes to create the pressure gradient.